Functions

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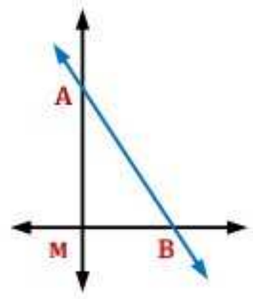
1 In the opposite figure :

The straight line L represents the function

$f : f(x) = nx + k$, MA = 6 length units

MB = 4 length units

Find : the values of n and m.



Solution ∵ MA = 6 l.u ∴ A (0 , 6)

∵ (0 , 6) ∈ the set of the function ∴ K = 6

∵ MB = 4 l.u ∴ B (4 , 0)

∵ (4 , 0) ∈ the set of the function ∴ $f(4) = 0$

∴ $4n + k = 0$ ∴ $4n + 6 = 0$ ∴ $n = -\frac{3}{2}$

2 In the opposite figure :

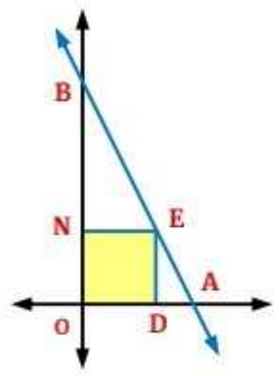
The linear function f where $f(x) = kx + n$

Represents graphically by a straight line $\overleftrightarrow{AB}$

Where A (3 , 0) , B (0 , 6) , DENO is a square

Find : 1 the rule of the function

2 the area of the square DENM



Solution ∵ (0 , 6) ∈ the set of the function ∴ n = 6

∵ (3 , 0) ∈ the set of the function ∴ $f(3) = 0$

∴ $3k + n = 0$ ∴ $3k + 6 = 0$ ∴ $k = -2$

∴ $f(x) = -2x + 6$

Let the side length of the square is L

∴ OD = DE = L ∴ E (L , L)

∵ (L , L) ∈ the set of the function ∴ $f(L) = L$

∴ $-2L + 6 = L$ ∴ $3L = 6$ ∴ L = 2 l.u

∴ The area of the square DENO = 2 × 2 = 4 s.u

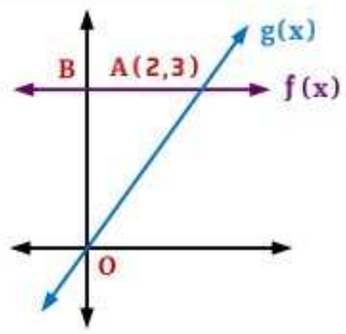
3 In the opposite figure :

$\overleftrightarrow{AB}$ Represents the constant function f

And $\overleftrightarrow{OA}$ Represents the linear function g

Where $g(x) = nx + m$, A (2 , 3)

Find : the values of n and m.



Solution ∵ (0 , 0) ∈ the set of the function g ∴ $g(0) = 0$

∴ $g(0) = 0$ ∴ m = 0

∵ (2 , 3) ∈ the set of the function g ∴ $g(2) = 3$

∴ $2n + m = 3$ ∴ $2n + 0 = 3$ ∴ $n = -\frac{3}{2}$

∴ $g(x) = -\frac{3}{2}n$

4 If the point (2 , 2) is the point of the vertex of the curve of the function f Where $f(x) = x^2 + nx + m$,

Find : the values of m and n .

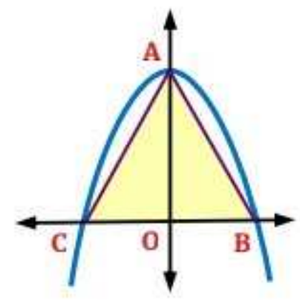
5 The opposite figure :

Represents the function f where

$f(x) = m - x^2$, OA = 4 l.u

Find : 1 the values of m .

2 the area of the triangle ABC



Solution ∵ OA = 4 l.u ∴ A (0 , 4)

∵ (0 , 4) ∈ the set of the function ∴ $f(0) = 4$

∴ $m - 0 = 4$ ∴ m = 4

Putting $f(x) = 0$ ∴ $4 - x^2 = 0$ ∴ $x^2 = 4$

∴ $x = \pm 2$ ∴ B (2 , 0) , C (-2 , 0)

∴ BC = 2 + 2 = 4 l.u

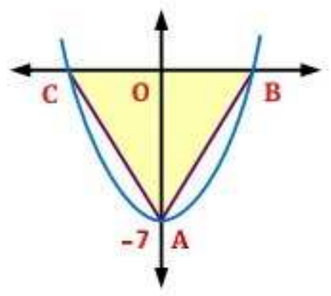
∴ Area of Δ ABC = $\frac{1}{2} \times BC \times OA = \frac{1}{2} \times 4 \times 4 = 8$ s.u

6 The opposite figure :

Represents the function f where

$f(x) = mx^2 - 7$, Area of Δ ABC = 21 s.u

Find the value of m .



Solution ∵ The area of Δ ABC = 21 s.u

∴ $\frac{1}{2} \times BC \times OA = 21$ ∴ $\frac{1}{2} \times BC \times 7 = 21$

∴ $\frac{7}{2} BC = 21$ ∴ $BC = 21 \times \frac{2}{7} = 6$ l.u

∵ the curve of the function is symmetric about Y – axis

∴ CO = OB = 3 l.u ∴ B (3 , 0) , C (-3 , 0)

∵ (3 , 0) ∈ the set of the function ∴ $f(3) = 0$

∴ $9m - 7 = 0$ ∴ $9m = 7$ $m = \frac{7}{9}$

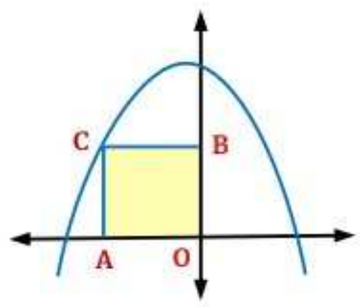
7 The opposite figure :

Represents the Curve of the function f

Where $f(x) = -x^2 - x + 5$

AOBC is a square

Find the area of the square AOBC



Solution Let the side length of the square is L

∴ A (-L , 0) , B (0 , L) , C (-L , L)

∵ (-L , L) ∈ the set of the function ∴ $f(-L) = L$

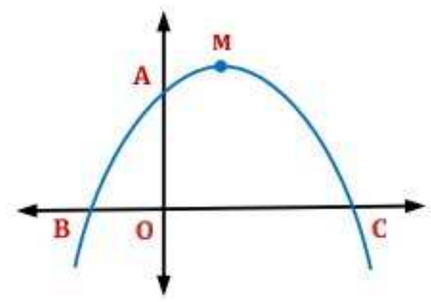
∴ $-L^2 + L + 5 = L$ ∴ $L^2 = 5$

∴ the area of the square AOBC = $L^2 = 5$ s.u

8 The opposite figure :

Represents the Curve of the Quadratic function f , A (0 , 3) , B (-2 , 0) , C (7 , 0)

Find $f(5)$



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Solution ∵ B (− 2 , 0) , C (7 , 0) ∴ f (− 2) = f (7)

∵ the curve of the function is symmetric

∴ f (− 1) = f (6) , f (0) = f (5)

∵ (0 , 3) ∈ the set of the function

∴ f (0) = 3 ∴ f (5) = 3

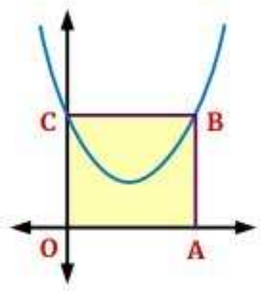
9 The opposite figure :

Represents the Curve of the function f

Where $f(x) = x^2 - (k-2)x - k + 4$

ABCO is a square

Find the value of k .



Solution Let the side length of the square is L

∴ OA = OC = AB = L l.u ∴ A (L , 0) , B (L , L) , C (0 , L)

∵ (0 , L) ∈ the set of the function ∴ f (0) = L

∴ 0 + (k − 2) × 0 − k + 4 = 0 ∴ 0 + (k − 2) × 0 − k + 4 = L

∴ L = 4 − k (1)

∵ $x = \frac{-b}{2a}$ = the midpoint of $\overline{BC}$ ∴ $\frac{k-2}{2} = \frac{L}{2}$

∴ L = k − 2 (2)

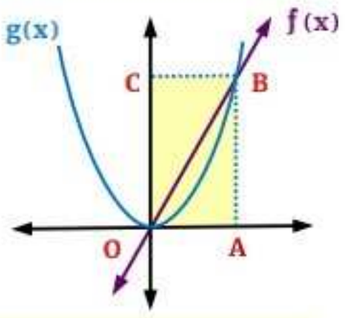
From (1) , (2) ∴ 4 − k = k − 2 ∴ k = 3

10 In the opposite figure :

If f and g are two polynomial functions

Where $f(x) = x^2$, $g(x) = 3x$

Find the area of the rectangle ABCO .



Solution Putting f (x) = g(x)

∴ $x^2 = 3x$ ∴ $x^2 - 3x = 0$ ∴ x (x − 3) = 0

∴ x = 0 or x = 3

At x = 3 y = 3 × 3 = 9 ∴ B (3 , 9)

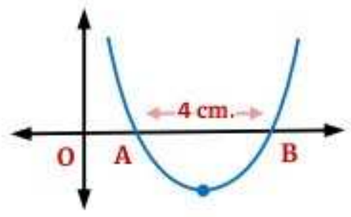
∴ the area of the rectangle = 3 × 9 = 27 s.u

11 the opposite figure :

Represents the Curve of the function f

Where $f(x) = x^2 - 6x + k$, AB = 4 cm.

Find the value of k .



Solution Let OA = L cm. ∴ A (L , 0)

∵ AB = 4cm. ∴ B (L + 4 , 0) ∴ f (L + 4) = f (L)

∴ $(L+4)^2 - 6(L+4) + k = L^2 - 6L + k$

∴ $L^2 + 8L + 16 - 6L - 24 = L^2 - 6L$ ∴ 8 L − 8 = 0

∴ L = 1 ∴ A (1 , 0)

∵ (1 , 0) ∈ the set of the function ∴ f (1) = 0

∴ 1 − 6 + k = 0 ∴ − 5 + k = 0 ∴ k = 5

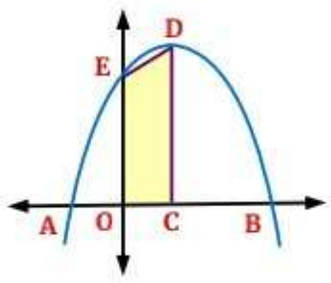
12 the opposite figure :

Represents the Curve of the function f

Where $f(x) = -x^2 + 2x + k - 1$, B (3 , 0)

, D the point of vertex of the curve

Find the area of the shape OCDE



Solution ∵ the curve of the function passes through (3 , 0)

∴ f (3) = 0 ∴ − 9 + 6 + k − 1 = 0 ∴ k = 4

∴ $f(x) = -x^2 + 2x + 3$

∵ $x = \frac{-b}{2a} = \frac{-2}{2 \times -1} = 1$, y = f (1) = − 1 + 2 + 3 = 4

∴ D (1 , 4) ∴ OC = 1 l.u , OC = 1 l.u

Putting x = 0 ∴ f (x) = 0 + 0 + 3 = 3

∴ OE = 3 l.u

∴ The area of the shape = $\frac{1}{2} \times (CD + OE) \times OA = \frac{1}{2} \times 7 \times 1 = 3.5$ s.u

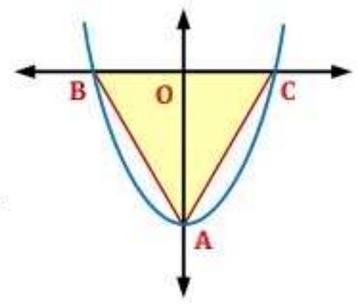
13 The opposite figure :

Represents the Curve of the function f

Where $f(x) = x^2 - k$

ABC is an equilateral triangle , its area $9\sqrt{3}$

Find the area value of k



Solution Let the side length of the triangle is L

∵ the area of the triangle = $\frac{\sqrt{3}}{4} L^2$ ∴ $\frac{\sqrt{3}}{4} L^2 = 9\sqrt{3}$

∵ $L^2 = 9\sqrt{3} \times \frac{4}{\sqrt{3}} = 36$ ∴ L = 6

∴ the height of the triangle = $\frac{\sqrt{3}}{2} L = \frac{\sqrt{3}}{2} \times 6 = 3\sqrt{3}$

∴ A (0 , $-3\sqrt{3}$)

∵ the curve of the function passes through (0 , $-3\sqrt{3}$)

∴ $-3\sqrt{3} = 0 - k$ ∴ $k = 3\sqrt{3}$

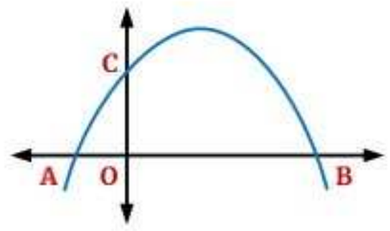
14 The opposite figure :

Represents the Curve of the function f

Where $f(x) = -x^2 + 4x + k - 1$

Whose intersects X-axis at A and B

, OA = 5 OB , Find the value of k .



Solution Let OA = L ∴ A (− L , 0) , B (5 L , 0)

∴ f (5 L) = f (− L)

∴ $-25L^2 + 20L + k - 1 = -L^2 - 4L + k - 1$

∴ $-24L^2 + 24L = 0$ ÷ − 24 ∴ $L^2 - L = 0$

∴ L (L − 1) = 0 ∴ L = 0 or L = 1

∴ A (− 1 , 0) , B (5 , 0)

∵ the curve of the function passes through (− 1 , 0)

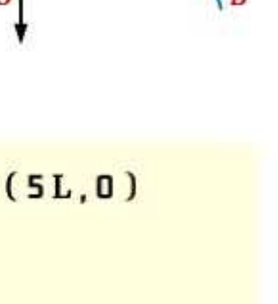
∴ f (− 1) = 0 ∴ − 1 − 4 + k − 1 = 0 ∴ k = 6

15 The opposite figure :

Represents the Curve of the function f

Where $f(x) = x^2$, ABCO is a square

Find The coordinates of A , B and C



Solution Let the diagonal length of the square = 2 L

∴ A (L , L) , B (0 , 2 L) , C (− L , L)

∵ the curve of the function passes through (L , L) ∴ f (L) = L

∴ $L^2 = L$ ∴ $L^2 - L = 0$ ∴ L (L − 1) = 0

∴ L = 0 or L = 1

∴ A (1 , 1) , B (− 1 , 1) , C (0 , 2)

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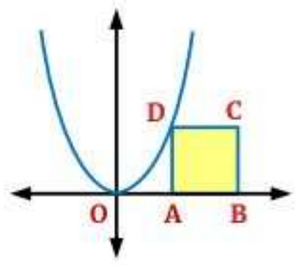
16 the opposite figure :

Represents the Curve of the function f

Where $f(x) = x^2$, B (6 , 0)

, ABCD is a square

Find the area of the square ABCD .



Solution Let OA = L l.u

$\therefore$ A (L , 0)

$\because$ B (6 , 0)

$\because$ ABCD is a square

$\therefore 6 - L = L^2$

$\therefore (L+3)(L-2) = 0$

$\therefore$ the side length of the square $= 2^2 = 4$ l.u

$\therefore$ The area of the square ABCD $= 4 \times 4 = 16$ s.u

$\therefore$ AD $= f(L) = L^2$

$\therefore$ AB $= 6 - L$

$\therefore$ AB = AD

$\therefore L^2 + L - 6 = 0$

$\therefore L = -3$ or $L = 2$

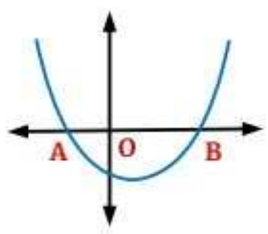
17 The opposite figure :

Represents the Curve of the function f

Where $f(x) = x^2 - ax + b$

, A (- 1 , 0) , B (2 , 0).

Find the values of a and b .



Solution $\because$ A (- 1 , 0) , B (2 , 0)

$\therefore f(-1) = f(2)$

$\therefore 1 + a + b = 4 - 2a + b$

$\therefore 1 + a = 4 - 2a$

$\therefore a = 1$

$\therefore f(x) = x^2 - x + b$

$\therefore f(2) = 0$

$\therefore 4 - 2 + b = 0$

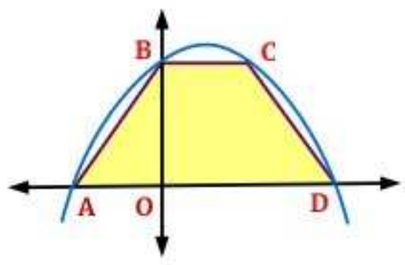
$\therefore b = 2$

18 The opposite figure :

Represents the Curve of the function f

, A (- 2 , 0) , B (0 , 3) , D (4 , 0) .

Find the area of the figure ABCD



Solution $\because$ A (- 2 , 0) , D (4 , 0)

$\therefore f(-2) = f(4)$

$\because$ the curve of the function is symmetric

$\therefore f(3) = f(-1)$, $f(2) = f(0)$

$\because$ (0 , 3) $\in$ the set of the function

$\therefore f(0) = 3$ $\therefore f(2) = 3$ $\therefore$ C (2 , 3)

$\therefore$ BC = 2 l.u , OB = 3 l.u , AD = 2 + 4 = 6 l.u

$\therefore$ The area of the shape $= \frac{1}{2} \times (AD + BC) \times OB = \frac{1}{2} \times 8 \times 3 = 12$ s.u

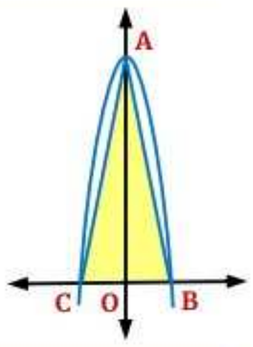
19 The opposite figure :

Represents the Curve of the function f Where

$f(x) = -kx^2 - (k-5)x + 4k$, Y - axis

is symmetric axis for the curve of the function

Find value of k , the area of the Δ ABC



Solution $\because$ the curve of the function is symmetric about X - axis

$\because k - 5 = 0$ $\therefore k = 5$ $\therefore f(x) = -5x^2 + 20$

Putting $x = 0$ $\therefore -5x^2 + 20 = 0$ $\therefore x^2 = 4$

$\therefore x = \pm 2$ $\therefore$ B (2 , 0) , C (- 2 , 0)

$\therefore$ The area of the Δ ABC $= \frac{1}{2} \times 4 \times 20 = 40$ s.u

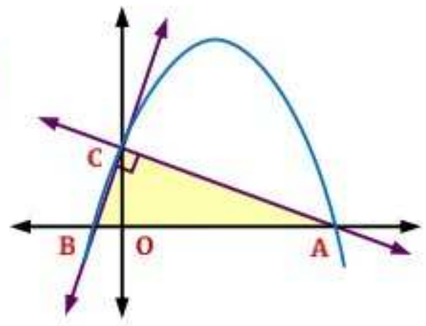
20 The opposite figure :

Represents the Curve of the function f

Where $f(x) = -\frac{1}{3}x^2 + kx + m$

$\overline{AC} \perp \overline{BC}$, OC = 3 l.u , OA = 9 OB

Find The the values of k and m



Solution $\because$ OA = 3 OB $\therefore$ OA = 9 L , OB = L

$\because$ the triangle ABC is right-angled triangle at B , $\overline{AC} \perp \overline{BC}$

$\therefore (OC)^2 = OA \times OB$ $\therefore 9 = 9L \times L$

$\therefore 9L^2 = 9$ $\therefore L^2 = 1$

$\therefore L = 1$ l.u $\therefore$ A (9 , 0) , B (- 1 , 0)

$\because$ the curve of the function passes through (0 , 3)

$\therefore f(0) = 3$ $\therefore m = 3$

$\because$ the curve of the function passes through (- 1 , 0)

$\therefore -\frac{1}{3} - k + m = 0$ $\therefore -\frac{1}{3} + k + 3 = 0$

$\therefore \frac{8}{3} + k = 0$ $\therefore k = -\frac{8}{3}$

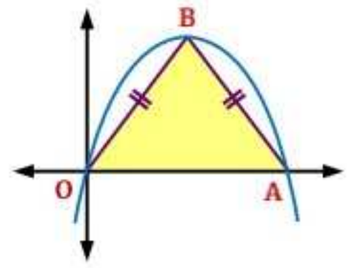
21 The opposite figure :

Represents the Curve of the function f

Where $f(x) = -\frac{4}{9}x^2 + \frac{8}{3}x$, AB = OB

Find 1 The coordinates of A , B

2 The Area of the triangle OAB



Solution Putting $f(x) = 0$ $\therefore -\frac{4}{9}x^2 + \frac{8}{3}x = 0$ ($\times 9$)

$\therefore -4x^2 + 24x = 0$ $\therefore -4x(x - 6) = 0$

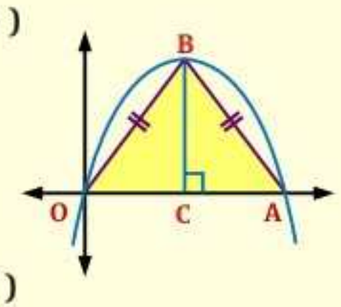
$\therefore x = 0$ or $x = 6$ $\therefore$ A (6 , 0)

By drawing $\overline{AC} \perp \overline{BC}$

$\because$ AB = OB , $\overline{AC} \perp \overline{BC}$

$\therefore$ C is the midpoint of $\overline{OA}$

$\therefore$ OC = 3 l.u $\therefore$ C (3 , 0)



$\therefore$ BC $= f(3) = -\frac{4}{9} \times 9 + \frac{8}{3} \times 3 = 4$ l.u $\therefore$ B (3 , 4)

$\because$ the triangle ABC is right-angled triangle at B

$\therefore (OB)^2 = 16 + 9 = 25$ $\therefore$ OB = 5 l.u

$\therefore$ The area of the Δ ABO $= \frac{1}{2} \times 6 \times 4 = 12$ s.u

Best wishes, mr.abdelrahman Essam

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موقع الدكتور محمد رزق التعليمي

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